BPA Service Area & Columbia River Basin

Figure 2.1

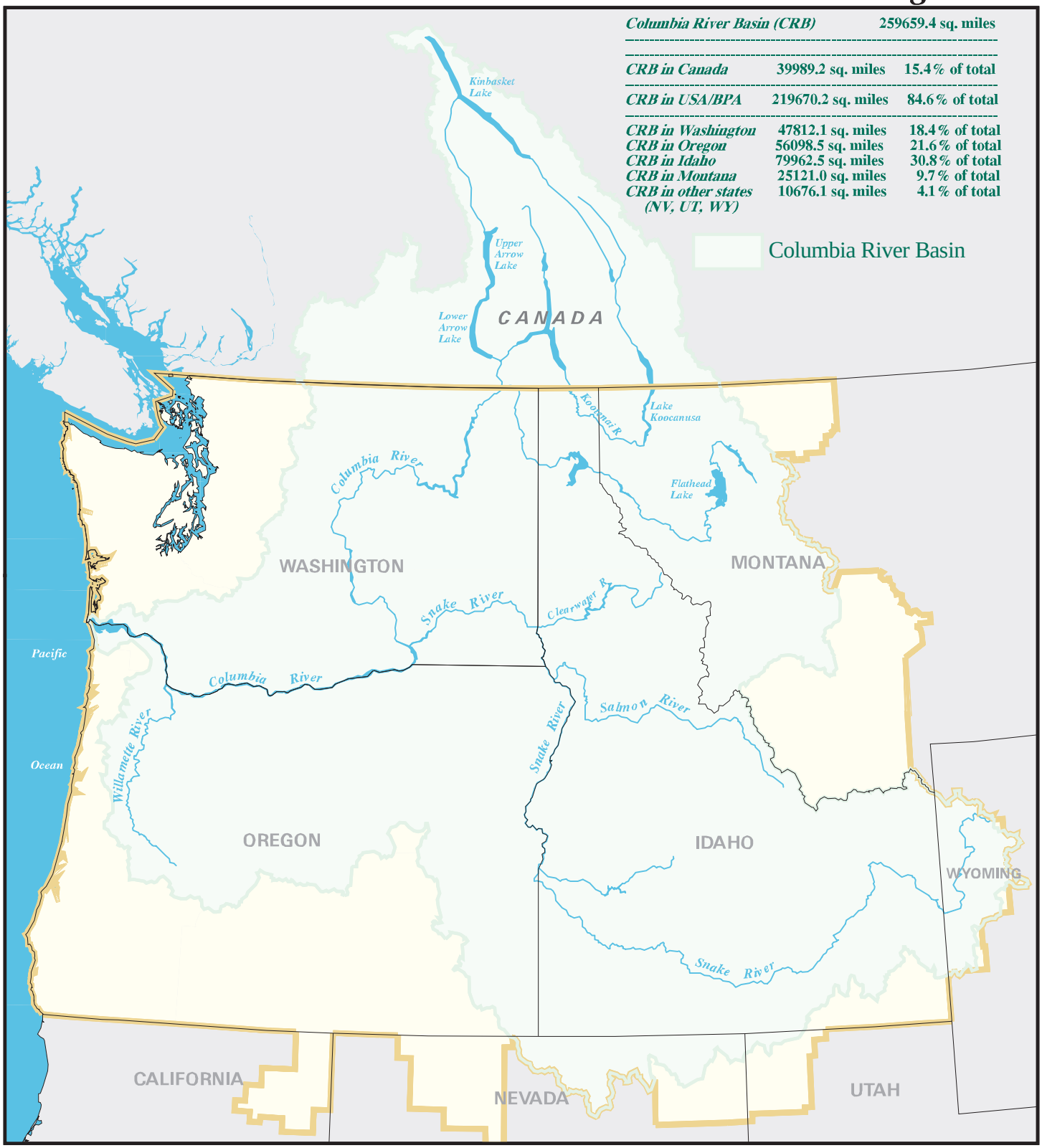
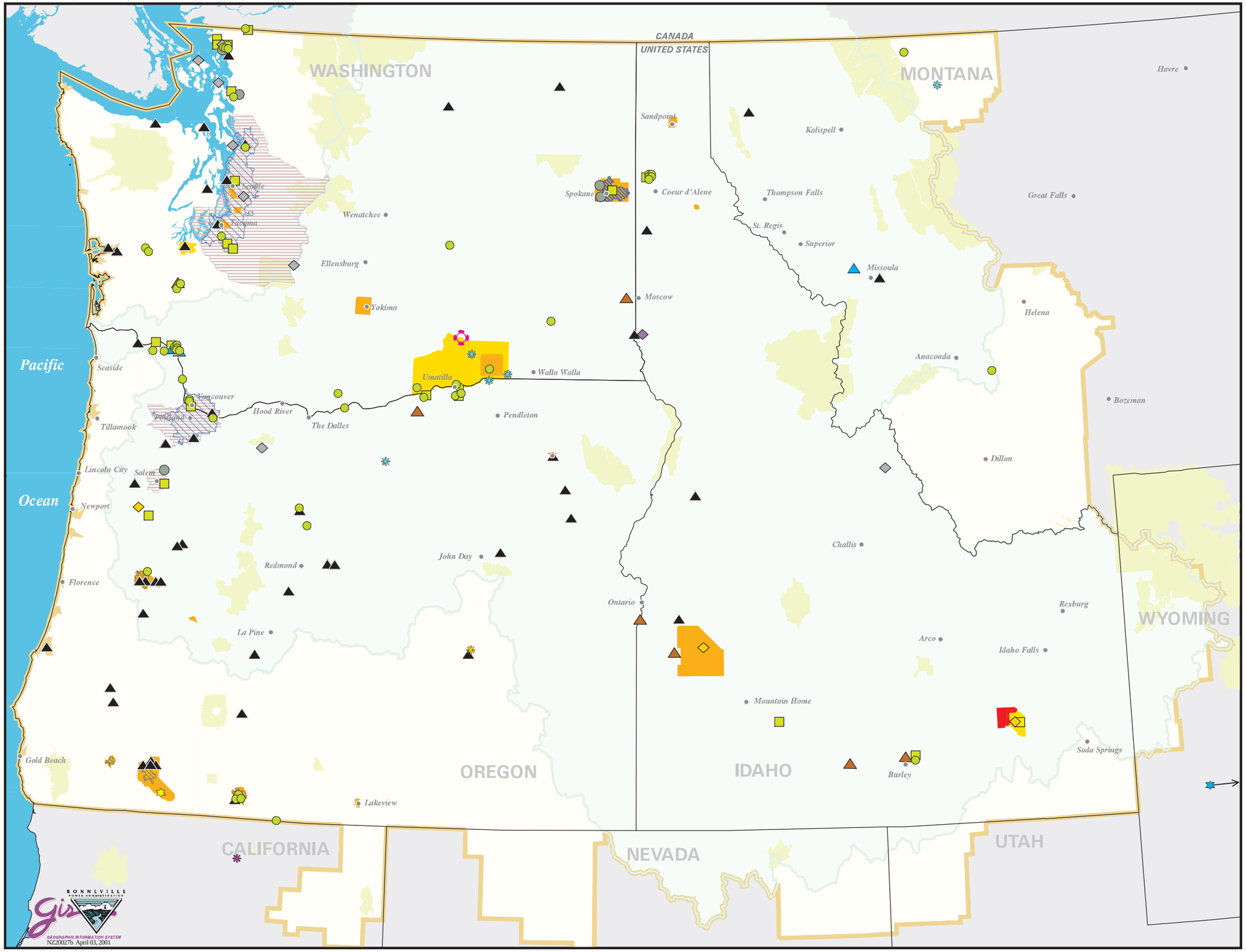


Figure 2.5

Air Quality and Non - Hydro Generation



Legend

Columbia River Basin

BPA Service Area

PM10 (particulate matter less than 10 micrometers)

- Maintenance
- Moderate
- Serious

CO (carbon monoxide - gas)

- Maintenance
- Moderate
- Serious

O3 (ozone - gas)

- Maintenance

Federal Class I Area

Thermal Plants (primary fuel type)

- Coal
- Oil
- Gas
- Biomass*
- Nuclear
- Municipal Solid Waste
- Black Liquor
- Raw Sulfur
- Biogas / Methane
- Multiple types

* Some biomass can be considered renewable.

Renewable Plants (primary fuel type)

- Solar
- Wind

Proposed Plants (primary fuel type)

- Gas
- Solar
- Wind
- Geothermal

* Locations of proposed plants are approximate and not intended represent legal or claimed locations.

0mi 100mi

0km 100km 200km

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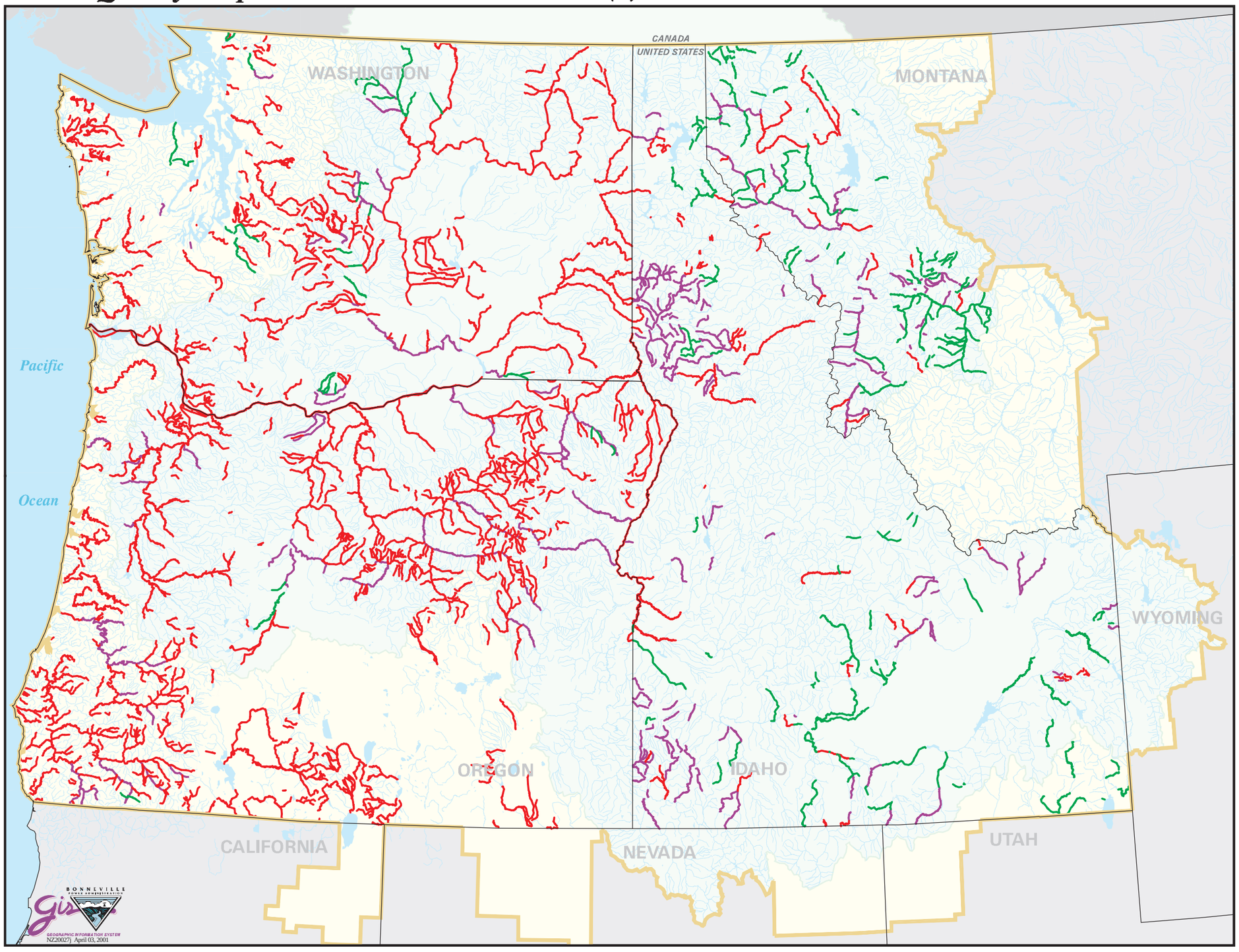
Figure 2.6

Water Quality Impaired Rivers - Section 303(d) - Clean Water Act



Legend

- Columbia River Basin
- BPA Service Area
- Flow Limited
- Temperature Limited
- Flow and Temperature Limited

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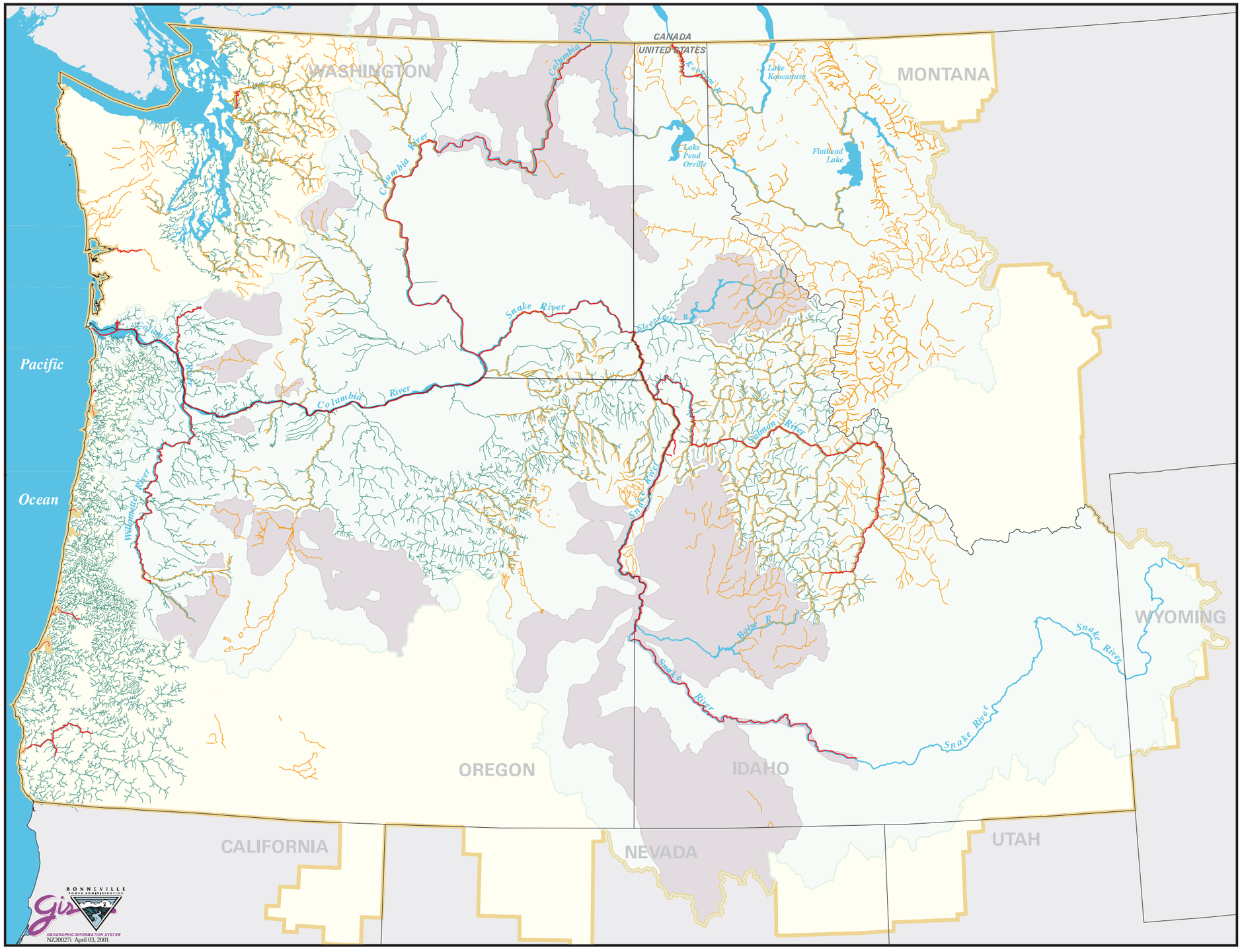
0mi 100mi

0km 100km 200km

Figure 2.7

Listed Anadromous and Resident Fish



Legend

- Columbia River Basin
- BPA Service Area
- Anadromous Fish Extinct
- Listed Anadromous Fish Species
- Listed Resident Fish - Bull Trout
- Listed Anadromous & Resident Fish - Sturgeon

Note: Fish distribution is generalized and actual historic and present ranges may differ.

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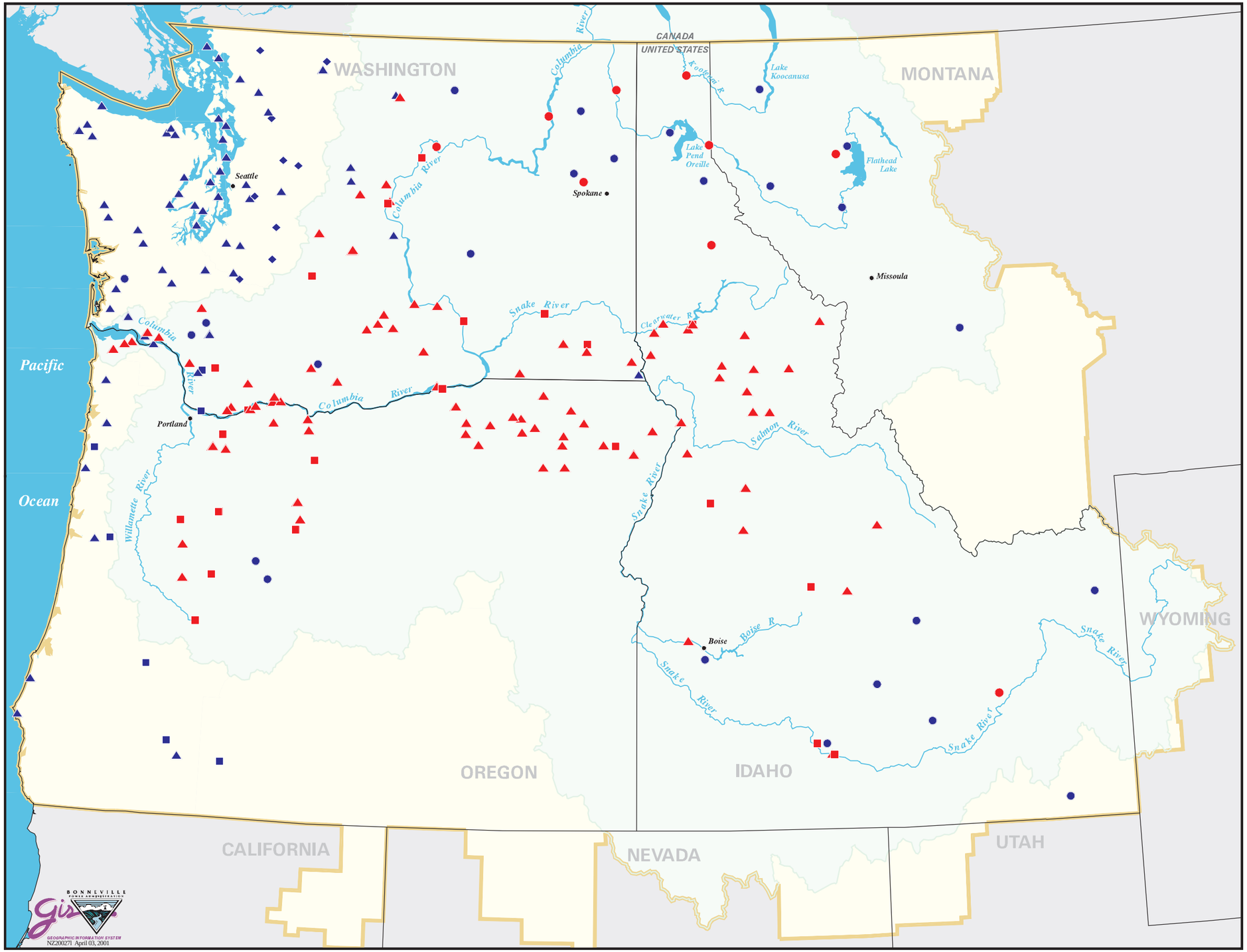
0km 100km 200km

Figure 2.8

Hatcheries



Legend

Columbia River Basin

BPA Service Area

Hatcheries *
(by type)

△ Anadromous Fish

○ Resident Fish

□ Both Anadromous and Resident

◇ Unknown or Unspecified

* Locations are approximate.

BPA Funded Hatcheries in red
Non - BPA Funded Hatcheries in blue

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0mi 100mi

0km 100km 200km

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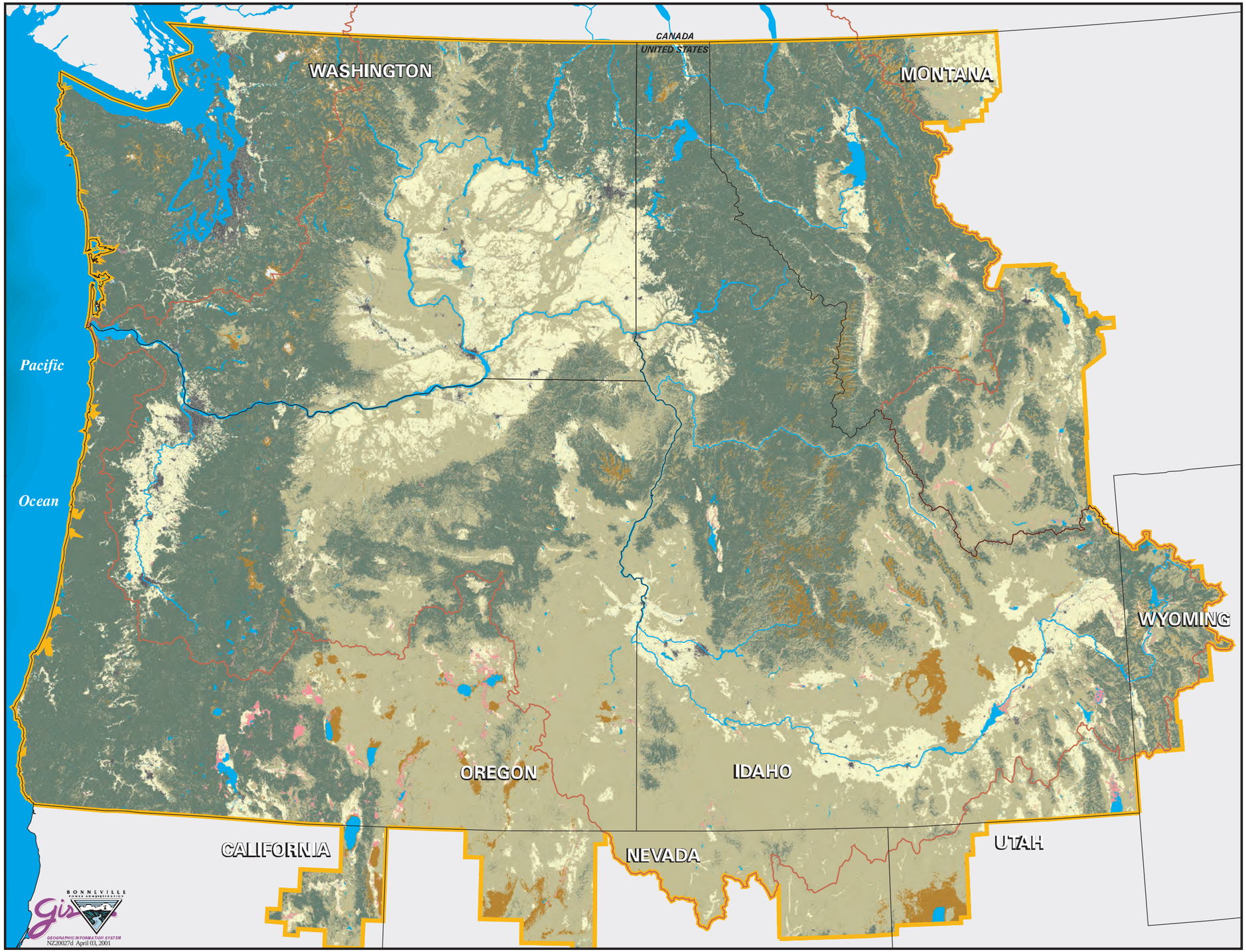
Figure 2.9

Land Use for the Pacific Northwest



Legend

Columbia River Basin

BPA Service Area Boundary

Land Use

- Residential, Commercial and Parks
- Bare Lands and Mining Areas
- Forest Lands
- Shrublands, Grasslands and Transitional Lands
- Agricultural Lands
- Wetlands

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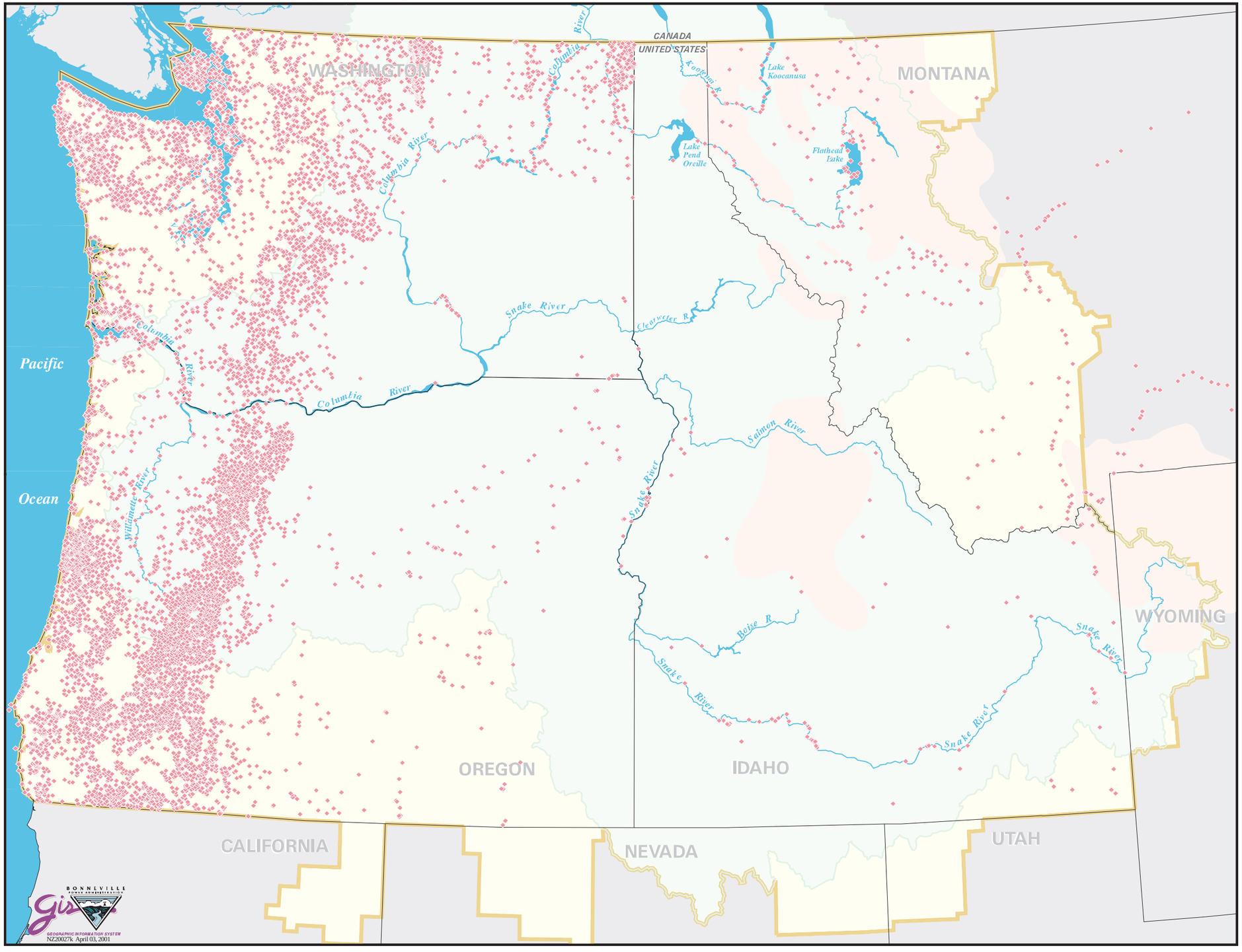
0mi 100mi

0km 100km 200km

Figure 2.10

Threatened and Endangered Species



Legend

Columbia River Basin

BPA Service Area

Threatened or Endangered Animal Species Territory

Note: Some species may have broad roaming ranges.

Threatened or Endangered Animal Obervation

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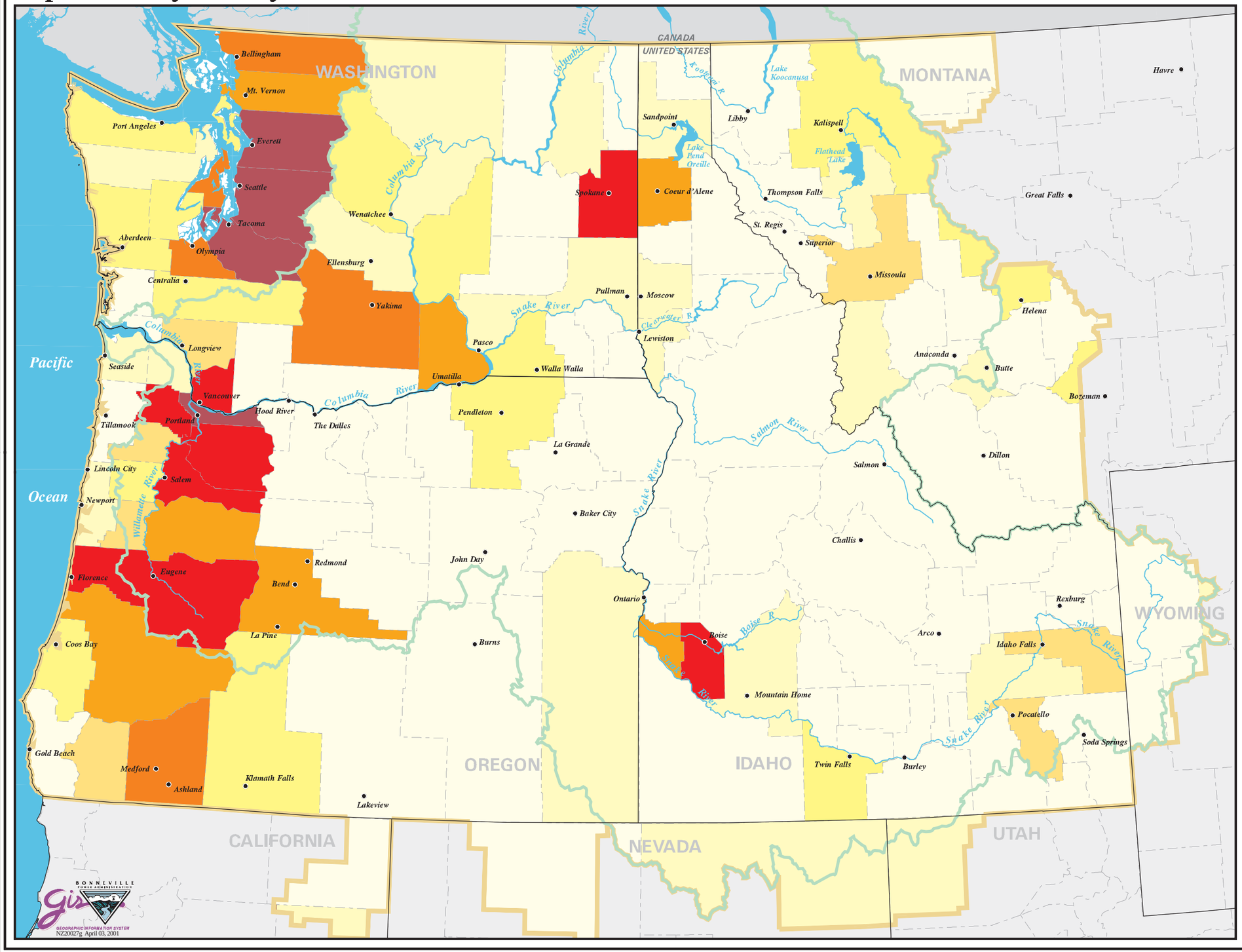
0mi 100mi

0km 100km 200km

Figure 2.11

Population by County



Legend

Columbia River Basin

BPA Service Area Boundary

POPULATION BY COUNTY
(1999 estimates)

- < 24,999
- 25,000 - 49,999
- 50,000 - 74,999
- 75,000 - 99,999
- 100,000 - 149,999
- 150,000 - 249,999
- 250,000 - 499,999
- > 500,000

Source: 1999 population figures were derived from the 1990 US Census Bureau figures (estimated by CACI International, Inc.)

N W E S

0mi 100mi

0km 100km 200km

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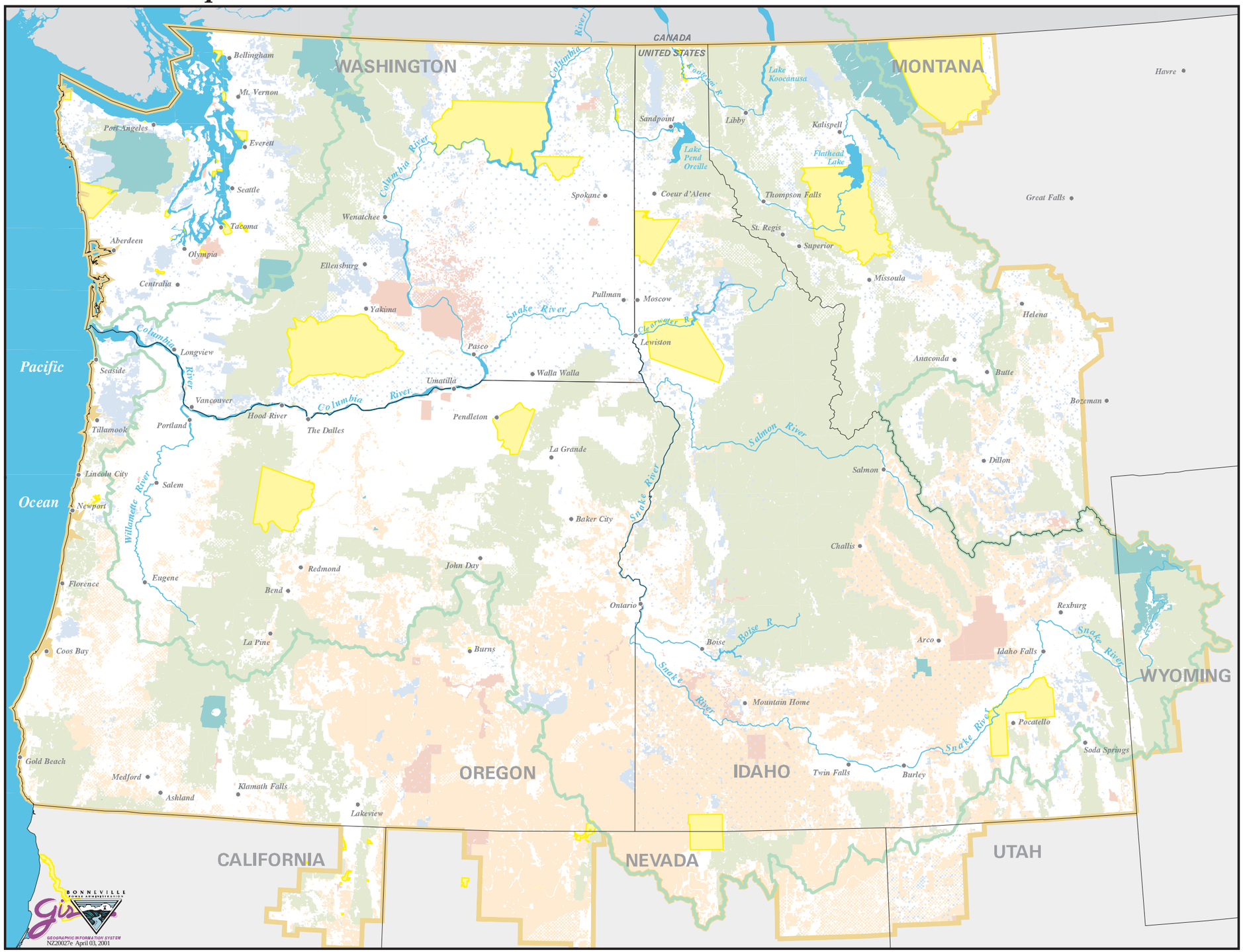
Figure 2.12

Land Ownership



Legend

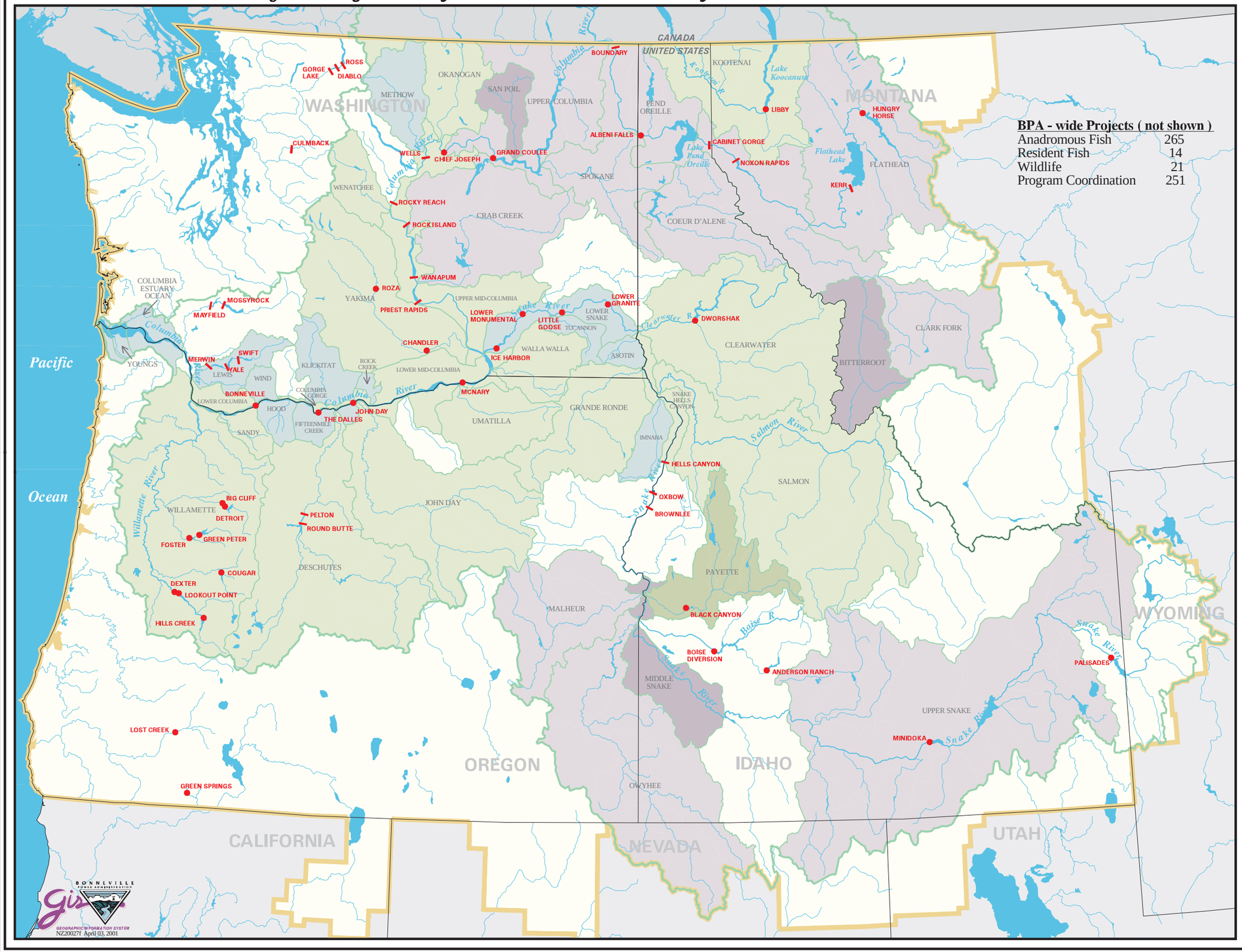
- Columbia River Basin
- BPA Service Area Boundary

Land Ownership

- Forest Service
- Federal Lands
- BLM
- National Park Service
- State Lands
- Tribal Lands

Figure 2.13

BPA Fish & Wildlife Projects by Subbasin and Hydro Sites



BPA - wide Projects (not shown)

Anadromous Fish	265
Resident Fish	14
Wildlife	21
Program Coordination	251

Legend

- Columbia River Basin
- BPA Service Area

Projects by Type

- Anadromous Fish
- Resident Fish
- Wildlife
- Resident Fish & Wildlife
- Multiple Types (Anadromous Fish, Resident Fish, Wildlife and Program Coordination)

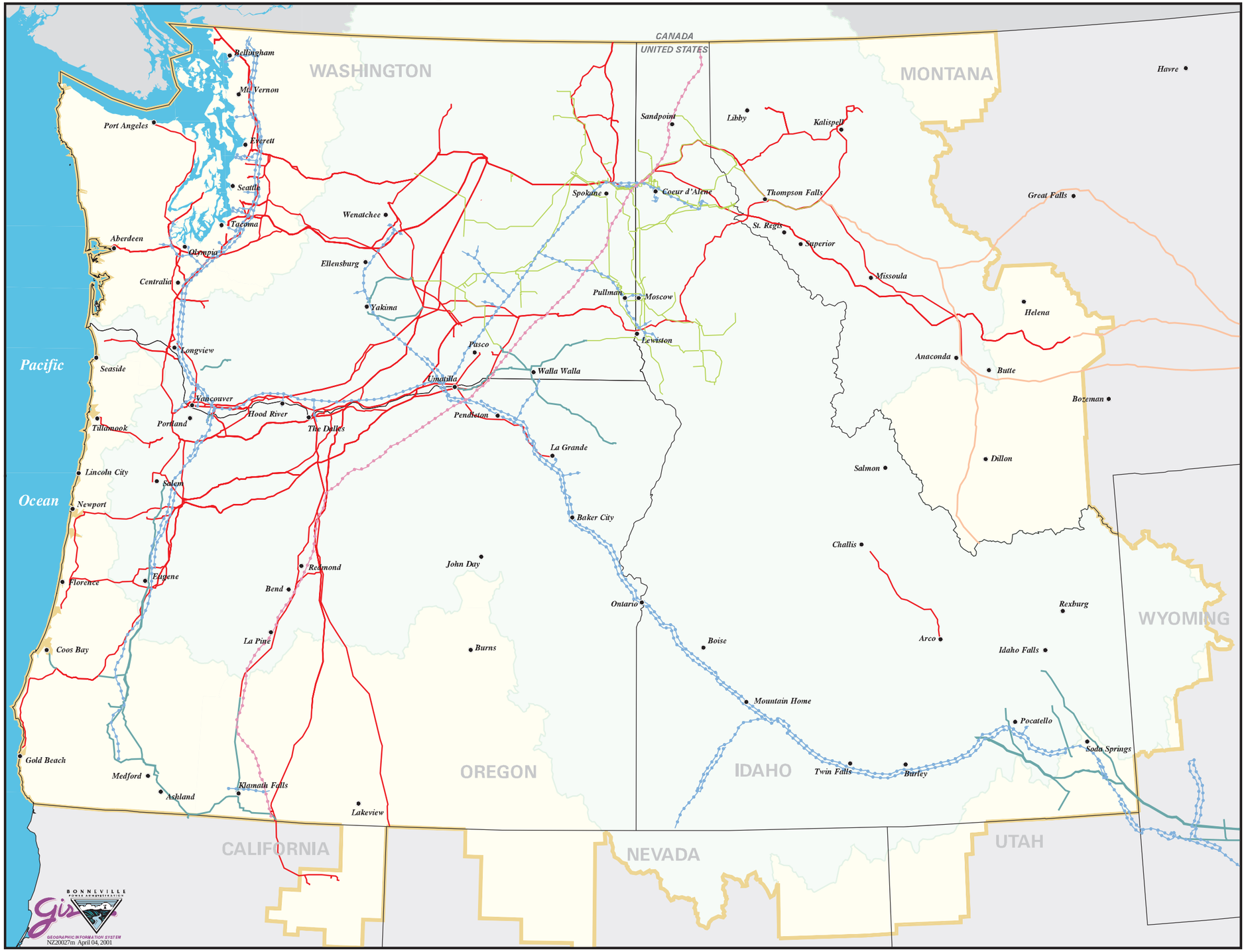
- Non - Federal Dam
- Federal Dam

N W E S

0mi 100mi

0km 100km 200km

Major Transmission and Gas Pipelines in the Pacific Northwest



Legend

Columbia River Basin

BPA Service Area

Gas Pipelines by Owner

Northwest Pipeline Corp.

Pacific Gas Transmission

Transmission Lines by Owner
(230kV and higher)

Bonneville Power Administration

Montana Power Co.

PacifiCorp.

Avista Corp.

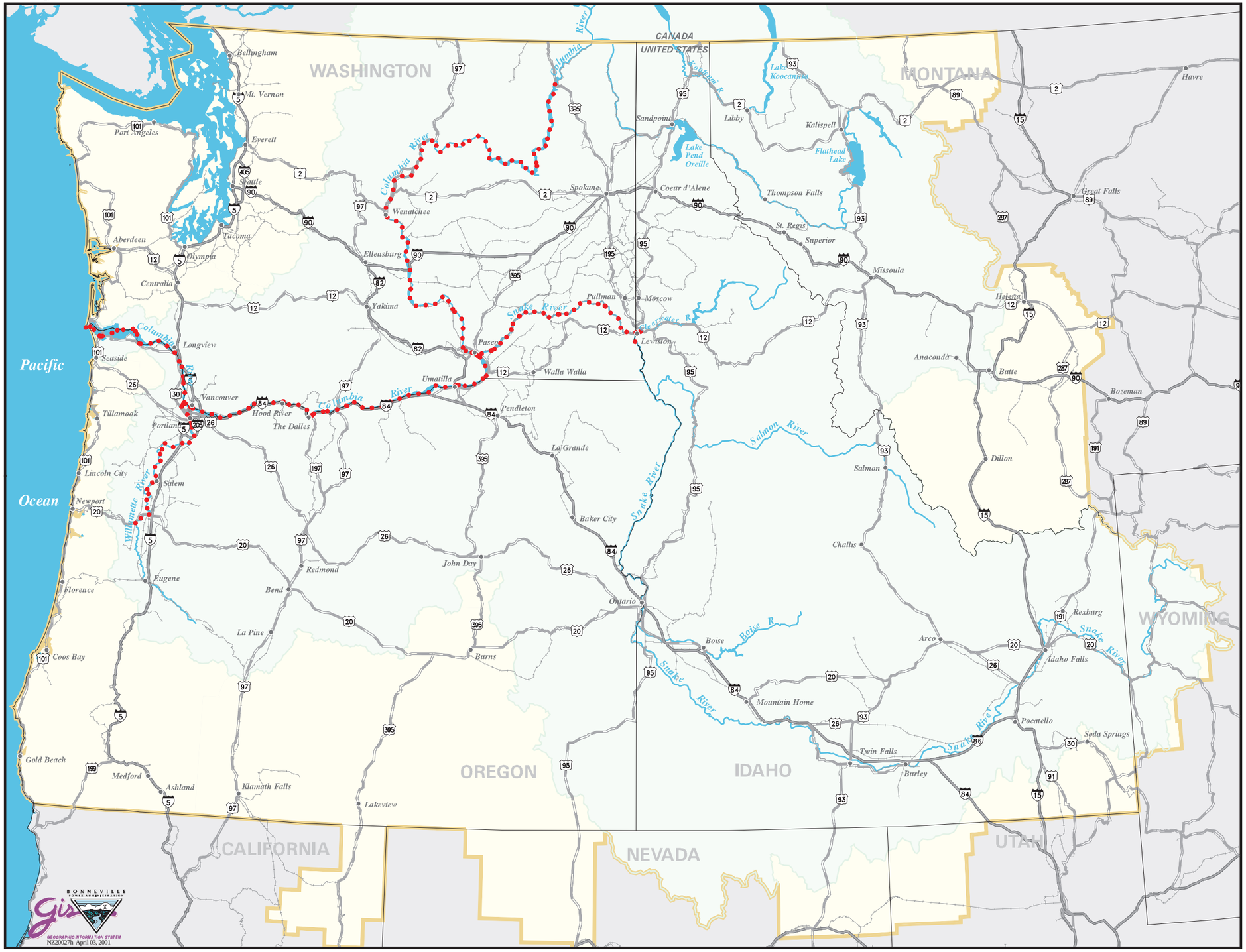
N
W E
S

0mi 100mi

0km 100km 200km

Figure 2.15

Major Transportation Routes



Legend

- Columbia River Basin
- BPA Service Area
- U.S. Highway
- Interstate Highway
- Railroad
- Navigable Channels for Commerce

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0mi 100mi
0km 100km 200km

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Figure 5-8

HABITAT -ORIENTED ACTIONS: INTENDED AND ASSOCIATED EFFECTS

The environment in which fish and wildlife live.

Intended Effects for Fish and Wildlife

- Improve survival of targeted fish and wildlife populations
- Restore, maintain, and enhance terrestrial and wetland habitats
- Protect and preserve upland and riparian habitats
- Reduce human activities
- Reduce soil disturbances
- Provide properly functioning ecosystems

- Modify river channels and stream beds
- Improve water quality
- Reduce discharges of point and non-point source pollutants to waterways
- Reduce stormwater runoff and erosion
- Restore natural hydrology
- Remove fish passage obstructions

- Improve the diversity, distribution, and viability of fish and wildlife populations
- Reduce "take" of designated critical habitat
- Perform enforcement, research, monitoring, and public education

Associated Side Effects on Humans

Possible adverse effects
- Restricted tourism
- Reduced sport and commercial fishing
- Reduced hunting
- Reduced agriculture
- Reduced timber harvest
- Limited livestock grazing
- Constrained urban and rural development
- Modified hydro operations

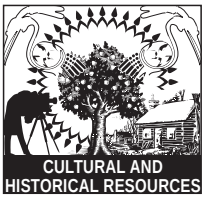
Mitigation measures
- Compensation through lease purchase and other incentives
- Landscape considerations
- Shift employment and economies

Possible adverse effects
- Impacts to culture, health, and spirituality

Mitigation measures
- Compensation

Possible adverse effects
- Land acquisition costs
- Land use compensation
- Increased mitigation costs
- Increased program costs

Mitigation measures
- Modify level of habitat-oriented actions
- Maximize effectiveness of fish and wildlife expenditures
- Spread costs proportionately



Possible adverse effects
- Exposure of archeological and historical resources

Mitigation measures
- Protection and documentation
- Planning

Possible adverse effects
- Changes in scenic qualities

Mitigation measures
- Siting and visual considerations

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Figure 5-9

HARVEST-ORIENTED ACTIONS: INTENDED AND ASSOCIATED EFFECTS

Commercial, sport, or other taking of fish and wildlife.

Intended Effects for Fish and Wildlife

- Development of facilities to support harvest

- Effluent from fish processing plants
- River traffic and water pollution from boats

- Population viability
- Diversity
- Distribution
- Control of predatory species
- Selective harvest seasons
- Selective harvest techniques
- Change in regulations
- Change in hatcheries operations
- Buy-back of commercial fishing licenses
- State and federal compensation

Associated Side Effects on Humans

Possible adverse effects
- Economic value of harvested species
- Reduced commercial fishing industry
- Altered tourism
- Reduced employment
- Impacts on urban and rural development

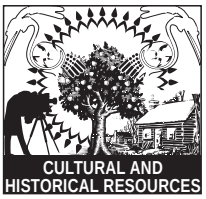
Mitigation measures
- Federal and state subsidies
- Species substitutions
- Buyout fishing permits

Possible adverse effects
- Reduced employment
- Impacts to cultural, health, and spiritual values

Mitigation measures
- Provide for treaty fishing
- Transfer some hatchery operations to tribes

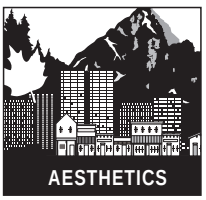
Possible adverse effects
- Cost of implementation and enforcement of regulations
- State and federal subsidies

Mitigation measures
- Public education
- Compensation
- Retraining and retooling



Possible adverse effects
- Impacts to cultural traditions associated with hunting and fishing

Mitigation measures
- Federal and state subsidies



Possible adverse effects
None identified

Figure 5-10

HATCHERY-ORIENTED ACTIONS: INTENDED AND ASSOCIATED EFFECTS

Artificial, human-built ways to add to the fish populations.

Intended Effects for Fish and Wildlife

- Minimal loss of terrestrial or riparian habitat

- Contamination from hatchery effluent
- Disease organisms from hatchery effluent
- Reduced water flow and level from hatchery diversions
- Fewer nutrients

- Increased harvest and predator pressure on wild fish
- Increased competition for food and habitat for wild fish
- Genetic changes in fish stocks from artificial selection and breeding
- Reduced biodiversity
- Disease transmission to wild fish
- Fish migration impeded by hatchery weirs and water

Associated Side Effects on Humans

Possible adverse effects
- Altered hydro operations
- Regulated sport and commercial fishing
- Shifted tourism
- Altered employment

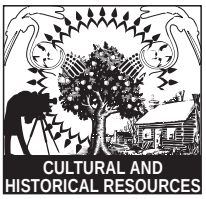
Mitigation measures
- Provide for sport and commercial fishing demand
- Hatchery research

Possible adverse effects
- Disenfranchisement of tribes as resource managers
- Economic impacts
- Amount and type of fish available for tribal harvest
- Tribal trust and treaty rights

Mitigation measures
- Provide for treaty fishing
- Transfer some hatchery operations to tribes

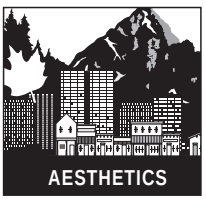
Possible adverse effects
- Fiscal impacts to tribal, state, and federal fish and wildlife programs

Mitigation measures
- Modify level of hatchery operations



Possible adverse effects
- Public perception that hatcheries mitigate habitat loss or degradation

Mitigation measures
- Public education



Possible adverse effects
- Visual effects of hatcheries in natural settings

Mitigation measures
- Appropriate landscape siting criteria

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Figure 5-11

HYDRO-ORIENTED ACTIONS:

Actions involving operations or changes to dams or other water control facilities

INTENDED AND ASSOCIATED EFFECTS

Intended Effects for Fish and Wildlife

- Connectivity of riparian and wetland habitats
- Erosion control measures
- Create replacement habitat

- Increase aquatic habitat volume, area, and quality through dam modifications and changes in operations
- Control water quality, fish passage, and in-reservoir storage
- Reservoir drawdown
- Altered river flows—daily and seasonally
- Altered water withdrawal
- Modified streambeds and stream banks
- Changes in channel morphology from reduced sediments downstream

- Increase survival of targeted species by improved aquatic habitat and migration conditions
- Changes in reservoir and diversion operations
- Changes in hydrosystem facilities
- Changes in fish numbers, species composition, and distribution
- Trucking or barging of fish
- Hatchery management

Associated Side Effects on Humans

Possible adverse effects

- Emissions from replacement energy generation facilities
- Pollution control devices
- Dust

Mitigation measures

- Shift to thermal generation or renewable resources
- Increase power imports or reduce exports
- Reduce electricity use (conservation)

Possible adverse effects

- Modified hydro operations and loss of power
- Affordable, reliable power supply
- Reduced commercial and sport fishing
- Constrained transportation and navigation
- Loss of irrigated croplands
- Reduced aluminum-producing facilities
- Reduced or delayed urban and rural development

Mitigation measures

- Hatchery production
- Facility siting considerations
- Pollution and erosion controls
- Efficient transportation practices

Possible adverse effects

- Impacts to tribal treaty rights
- Impacts to traditional cultural properties
- Impacts to culture, health, and spirituality
- Impacts to tribal employment

Mitigation measures

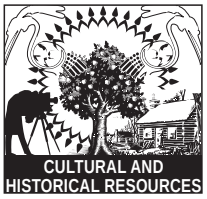
- Modify hydro operations
- Improve and expand hatcheries
- Provide compensation

Possible adverse effects

- Increased costs for irrigating farmland
- Increased costs for fish and wildlife recovery/mitigation programs
- Impact on property values
- Energy costs
- Cost of incentives for farmers to grow nonirrigated crops

Mitigation measures

- Reduce level of hydro modifications

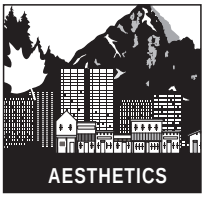


Possible adverse effects

- Loss or exposure of archeological and historical sites

Mitigation measures

- Documentation and protection



Possible adverse effects

- Views of natural environment are disturbed

Mitigation measures

- Zoning and design criteria in land use regulations

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Figure 5-12

FORESTRY

TYPICAL ENVIRONMENTAL IMPACTS TO FISH AND WILDLIFE

Possible adverse effects:
- Habitat degradation
- Erosion
- Loss of habitat (including riparian habitat)
- Loss of habitat connectivity

Mitigation measures:
- Manage forests to benefit wildlife
- Restore harvested land to native habitat
- Improve forest structure, pattern, and species composition

Possible adverse effects:
- Runoff
- Pollution
- Sedimentation

Mitigation measures:
- Modify forestry practices to control runoff
- Close or obliterate forest roads
- Manage riparian areas for water quality

Possible adverse effects:
- Fish and wildlife population viability
- Fish and wildlife density
- Fish and wildlife diversity

Mitigation measures:
- Regulations and enforcement
- Modify harvest techniques
- Close or obliterate forest roads
- Protect lands to allow natural habitat development

Figure 5-13

TYPICAL ENVIRONMENTAL IMPACTS TO FISH AND WILDLIFE AND AGRICULTURE AND GRAZING

Possible adverse effects:
- Habitat degradation
- Erosion
- Loss of habitat and habitat connectivity
- Crops provide food source and open spaces

Mitigation measures:
- Manage range land and cropland to benefit wildlife
- Convert land to native habitat

Possible adverse effects:
- Runoff
- Water diversion
- Pollution
- Sedimentation

Mitigation measures:
- Fence out livestock
- Modify agricultural practices to control runoff
- Retire irrigated land
- Screen irrigation diversions to protect salmon

Possible adverse effects:
- Sedimentation reduces fish egg survival

Mitigation measures:
- Pollution control measures
- Buffers
- Habitat connectivity

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Figure 5-14

RECREATION
TYPICAL ENVIRONMENTAL IMPACTS TO FISH AND WILDLIFE

Possible adverse effects:
- Habitat degradation
- Loss of habitat
- Loss of habitat connectivity
- Erosion
- Weed dispersal and simplification

Mitigation measures:
- Locate recreational activities away from fish and wildlife habitat
- Public education
- Regulations and enforcement
- Density management
- Habitat restoration
- Native landscaping

Possible adverse effects:
- Habitat degradation
- Loss of habitat
- Pollution

Mitigation measures:
- Locate recreational activities away from fish and wildlife habitat
- Public education
- Regulations and enforcement

Possible adverse effects:
- Fish and wildlife population viability
- Fish and wildlife density
- Fish and wildlife diversity
- Harassment
- Hunting and fishing

Mitigation measures:
- Regulations and enforcement
- Public education
- Develop or improve alternative recreational opportunities

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Figure 5-15

MINING
TYPICAL ENVIRONMENTAL IMPACTS TO FISH AND WILDLIFE

Possible adverse effects:
· Habitat loss and degradation
· Erosion

Mitigation measures:
· Land management practices to benefit fish and wildlife
· Convert mined areas to native or reclaimed habitat

Possible adverse effects:
· Runoff
· Water diversion
· Pollution and sedimentation

Mitigation measures:
· Modify mining practices to control runoff and sedimentation
· Convert mined areas to native habitat
· Enhance buffers

Possible adverse effects:
· Fish and wildlife population liveability
· Fish and wildlife diversity
· Fish and wildlife distribution

Mitigation measures:
· Convert mined areas to native habitat
· Modify mining practices to control pollution and runoff

Figure 5-16

URBAN AND RURAL DEVELOPMENT

TYPICAL ENVIRONMENTAL IMPACTS TO FISH AND WILDLIFE

Possible adverse effects:
- Habitat loss or degradation
- Erosion
- Loss of habitat connectivity
- Increased wildfire hazards

Mitigation measures:
- Locate urbanization away from sensitive areas
- Acquire easements of sensitive habitat
- Public education
- Retain roadless areas
- Regulations and enforcement
- Road maintenance and improvements
- Limit public access or use

Possible adverse effects:
- Runoff
- Water diversion
- Pollution and sedimentation

Mitigation measures:
- Acquire easements of sensitive habitat
- Pollution control measures
- Limit public access or use
- Buffers
- Aquire water rights

Possible adverse effects:
- Fish and wildlife population viability
- Fish and wildlife distribution
- Fish and wildlife diversity

Mitigation measures:
- Zoning to protect fish and wildlife
- Locate urbanization away from sensitive areas
- Preserves

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Figure 5-17

WATER WITHDRAWALS
TYPICAL ENVIRONMENTAL IMPACTS TO FISH AND WILDLIFE

Possible adverse effects:
- Habitat degradation
- Loss of habitat
- Land use conversions
- Fragmentation from water conveyance structures

Mitigation measures:
- Retire irrigated land
- Fallow irrigated land during dry years
- Dryland farming
- Aquifer storage and recovery

Possible adverse effects:
- Dewatering of streams and rivers
- Change in water levels and flows
- Impede access to fish spawning areas
- Lower groundwater tables

Mitigation measures:
- Irrigation water conservation techniques
- Convert land to dryland farming or native habitat
- Aquifer storage and recovery

Possible adverse effects:
- Fish mortality or stress
- Fish and wildlife populations

Mitigation measures:
- Screen irrigation diversions to avoid fish mortality
- Convert land to native habitat

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Figure 5-18

TYPICAL ENVIRONMENTAL IMPACTS TO FISH AND WILDLIFE

RENEWABLE ENERGY

Possible adverse effects:
· Relatively large loss of habitat
· Construction-related erosion

Mitigation measures:
· Locate generating facilities away from sensitive areas
· Erosion control measures

Possible adverse effects:
· Construction-related runoff

Mitigation measures:
· Erosion control measures

Possible adverse effects:
· Fish and wildlife populations
· Injuries from contact with generating facilities

Mitigation measures:
· Locate generating facilities away from sensitive areas
· Modify design of generating facilities

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Figure 5-19

NONRENEWABLE ENERGY

TYPICAL ENVIRONMENTAL IMPACTS TO FISH AND WILDLIFE

Possible adverse effects:
· Habitat degradation
· Relatively small habitat loss

Mitigation measures:
· Locate generating facilities away from sensitive areas
· Emission control measures

Possible adverse effects:
· Pollution
· Increased water temperature
· Water diversions

Mitigation measures:
· Pollution control measures
· Water cooling measures
· Acquire water rights

Possible adverse effects:
· Fish and wildlife population liveability
· Fish and wildlife diversity
· Fish and wildlife distribution
· Collisions

Mitigation measures:
· Locate generating facilities away from sensitive areas
· Emission control measures

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Figure 5-20

TRANSMISSION LINES

TYPICAL ENVIRONMENTAL IMPACTS TO FISH AND WILDLIFE

Possible adverse effects:
- Construction- and maintenance-related erosion
- Loss of habitat
- Vegetation removal and herbicide use
- Habitat fragmentation
- Migration barriers
- Weed dispersal

Mitigation measures:
- Nontoxic vegetation removal
- Erosion control measures
- Locate lines to avoid sensitive areas
- Vegetation conversions

Possible adverse effects:
- Construction- and maintenance-related runoff

Mitigation measures:
- Modify construction and maintenance practices

Possible adverse effects:
- Fish and wildlife distribution
- Fish and wildlife population movement
- Collisions
- Electrocution

Mitigation measures:
- Locate lines to avoid sensitive areas

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